555 Timer Ball Whacker

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PARTS:

- Servo Motor (1)
  from an RC plane/boat/car shop
- Breadboard (1)
  from RadioShack
- Resistor (1)
  from RadioShack.
- Photoresistor (1)
  from RadioShack.
- Diodes (1)
  from RadioShack.
- Desk lamp (1)
- Plywood (1)
  1/4".
- Polystyrene ball (1)
  or other lightweight, swattable object.
- Carriage bolt (1)
  4".
- Batteries (3)
  from RadioShack.
- Battery Holder 3XAAA (1)

from RadioShack.

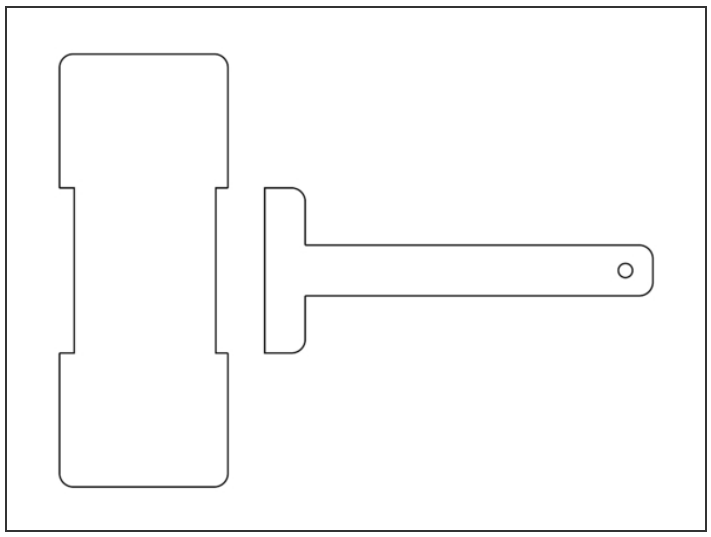
- 555 Timer IC (1)
  from RadioShack.
- Electrolytic Capacitor 1.0uF (1)
  from RadioShack
- Electrolytic Capacitor 1000uF (1)
  from RadioShack
- Jeweler's wire (1)

SUMMARY

This project uses a simple 555 timer chip and a feedback loop to control a servo-controlled wooden arm. Whenever an object comes close to a photosensor mounted on the end of the arm, it blocks the amount of light detected, which triggers the arm to swat the object away.

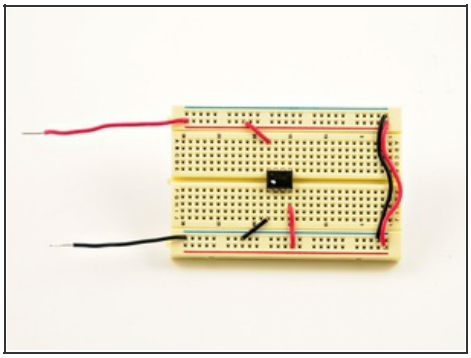
Check out more Weekend Projects.

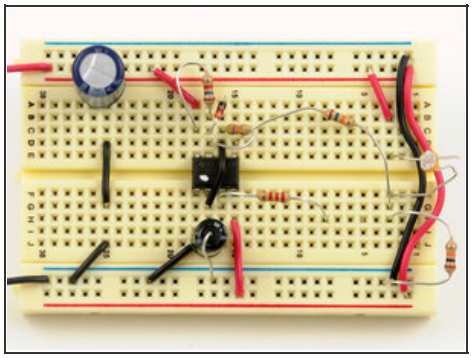
Step 1 — Create the Stand

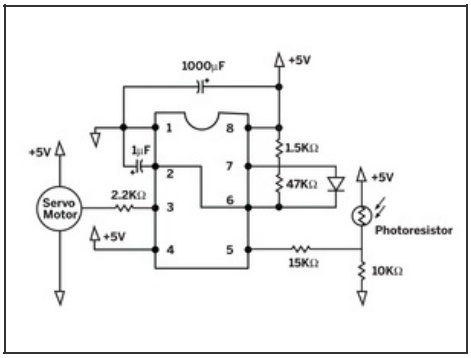


- I designed a simple frame to hold all the parts, cut from 1/4" birch plywood.
- For this design, you can use a 4" carriage bolt across the top, from which gold wire and thread can be tied to suspend the "ball," in this case, a plastic egg.
- Here's a simple template that can be used to cut out your own stand. Feel free to tweak it to your liking.

Step 2 — Populate the Breadboard

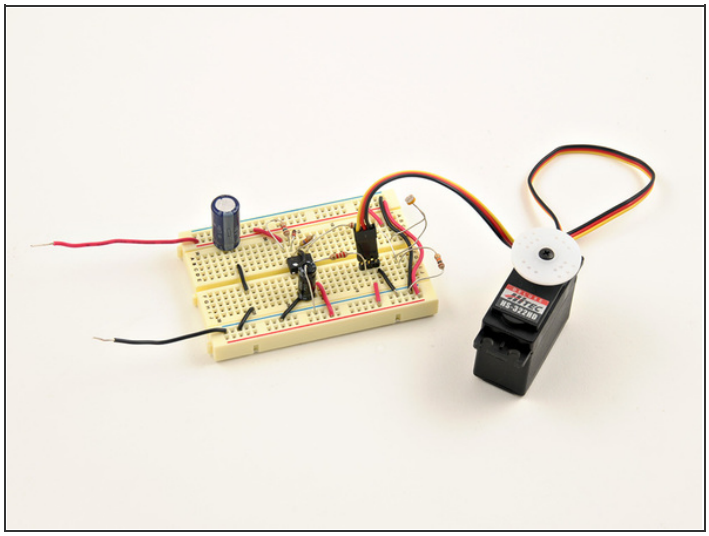


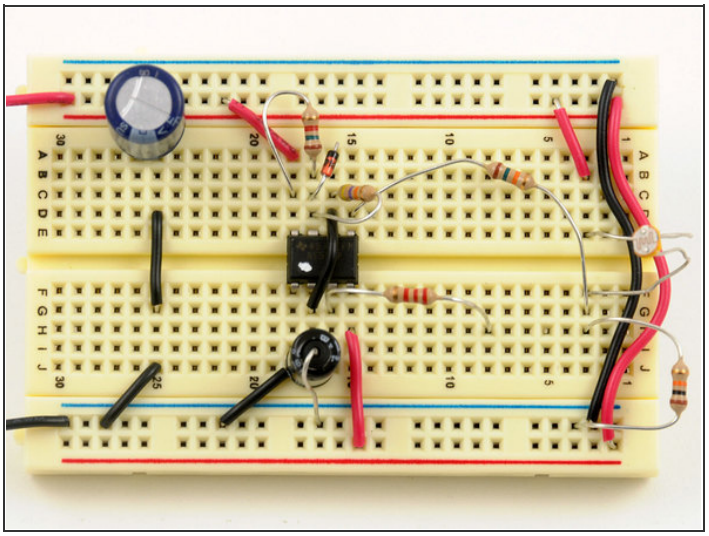




- Install the 555 timer on the breadboard, straddling the central "trench."
- Add the resistors: 1.5kΩ (Brown-Green-Red-Gold), 47kΩ (Yellow-Violet-Orange-Gold), 15kΩ (Brown-Green-Orange-Gold), 2.2kΩ (Red-Red-Red-Gold), 10kΩ (Brown-Black-Orange-Gold)
- Add the 1000 F and 1 F capacitors. These are polarized and need to go in the right way around.
- Add the diode. This is also polarized and needs to go in the right way around.
- The schematic here shows all of the connections.

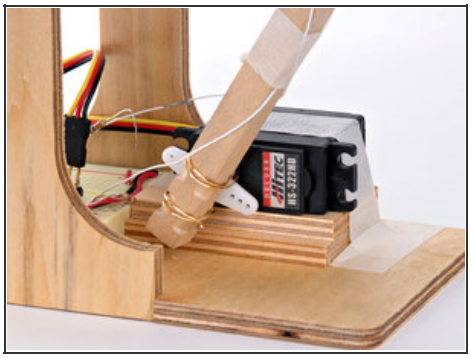
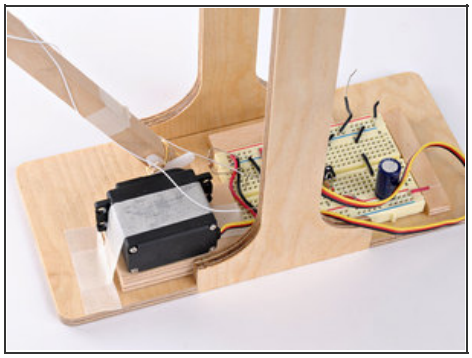
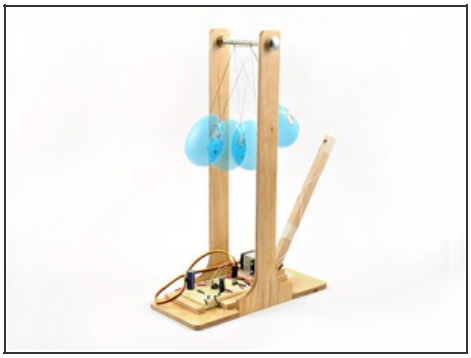
Step 3 — Connect the Offboard Components





- Wire up the servo's red (+5v), black (Gnd), and yellow (Control) connections from the circuit on the breadboard.
- Connect the photoresistor (aka light-dependent resistor or LDR) to the circuit using wires long enough to reach up the wooden arm.
- Drill a small hole in the end of the arm to hold the photodiode and insert it. Tape the wires down the arm to the breadboard.
- Attach the wooden arm to the servomotor such that it leans slightly away from the ball. Mount the breadboard and servomotor onto the stand.
- Connect the battery holder to the power and ground rails along the sides of the breadboard.
- The connections you may not be able to see on the breadboard (second photo) are: Diode to Pin 6 of the IC, large cap between +5V and the 6th column of holes, small cap between Ground and Pin 2 of the IC.

Step 4 — Final Setup

- I built the frame from what I had lying around. To hold the servo and breadboard, I glued down a few off-cuts of plywood.
- For the arm, I used a 6" piece of square dowel. I wrapped the photoresistor wires around it and secured them with tape.
- I used jeweler's wire to secure the arm to the servo — just loop the wire around and twist it tight.
- Position a desk lamp so that it shines light towards the photosensor, from the other side of the hanging object.
- Insert batteries into the battery holder and watch the fun. If the arm swings the wrong way, turn the servomotor around.
- It might take some tweaking to find the "sweet" spot" where the light/sensor/ball all align to create the whacking action. But when you get it, it's pretty funny to watch...
- You can see the ball whacker in action here.

This project is a great example of a cybernetic, or "self-governing" system. These kinds of systems have been around since the steam age (check out fly-ball governors for an early example of the technology).

With this kind of analog robotic control system. remarkably human-like behaviour can be obtained without the need for complex digital programming.

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